INTERNATIONAL STANDARD

IEC 62305-1

First edition
2006-01

Protection against lightning –

Part 1:
General principles

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

Reference number
IEC 62305-1:2006(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XB

For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING –

Part 1: General principles

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62305-1 has been prepared by IEC technical committee 81: Lightning protection.

The IEC 62305 series (Parts 1 to 5), is produced in accordance with the New Publications Plan, approved by National Committees (81/171/RQ (2001-06-29)), which restructures and updates in a more simple and rational form the publications of the IEC 61024 series, the IEC 61312 series and the IEC 61663 series.

The text of this first edition of IEC 62305-1 is compiled from and replaces

– IEC 61024-1-1, first edition (1993).

The text of this standard is based on the following documents:

FDIS	Report on voting
81/262/FDIS	81/267/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted, as close as possible, in accordance with the ISO/IEC Directives, Part 2.

IEC 62305 consists of the following parts, under the general title *Protection against lightning*:

Part 1: General principles

Part 2: Risk management

Part 3: Physical damage to structures and life hazard

Part 4: Electrical and electronic systems within structures

Part 5: Services[1]

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

[1] To be published

INTRODUCTION

There are no devices nor methods capable of modifying the natural weather phenomena to the extent that they can prevent lightning discharges. Lightning flashes to, or nearby, structures (or services connected to the structures) are hazardous to people, to the structures themselves, their contents and installations as well as to services. This is why the application of lightning protection measures is essential.

The need for protection, the economic benefits of installing protection measures and the selection of adequate protection measures should be determined in terms of risk management. Risk management is the subject of IEC 62305-2.

The criteria for design, installation and maintenance of lightning protection measures are considered in three separate groups:

– the first group concerns protection measures to reduce physical damage and life hazard in a structure is given in IEC 62305-3,

– the second group concerns protection measures to reduce failures of electrical and electronic systems in a structure is given in IEC 62305-4,

– the third group concerns protection measures to reduce physical damage and failures of services connected to a structure (mainly electrical and telecommunication lines) is given in IEC 62305-5.

PROTECTION AGAINST LIGHTNING –

Part 1: General principles

1 Scope

This part of IEC 62305 provides the general principles to be followed in the protection against lightning of

– structures including their installations and contents as well as persons,
– services connected to a structure.

The following cases are outside the scope of this standard:

– railway systems;
– vehicles, ships, aircraft, offshore installations;
– underground high pressure pipelines;
– pipe, power and telecommunication lines not connected to a structure.

NOTE Usually these systems are under special regulations made by various specific authorities.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62305-2, *Protection against lightning – Part 2: Risk management*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

IEC 62305-5, *Protection against lightning – Part 5: Services* [2]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
lightning flash to earth
electrical discharge of atmospheric origin between cloud and earth consisting of one or more strokes

[2] To be published.

3.2
downward flash
lightning flash initiated by a downward leader from cloud to earth

NOTE A downward flash consists of a first short stroke, which can be followed by subsequent short strokes. One or more short strokes may be followed by a long stroke.

3.3
upward flash
lightning flash initiated by an upward leader from an earthed structure to cloud

NOTE An upward flash consists of a first long stroke with or without multiple superimposed short strokes. One or more short strokes may be followed by a long stroke.

3.4
lightning stroke
single electrical discharge in a lightning flash to earth

3.5
short stroke
part of the lightning flash which corresponds to an impulse current

NOTE This current has a time to the half value T_2 typically less than 2 ms (see Figure A.1).

3.6
long stroke
part of the lightning flash which corresponds to a continuing current

NOTE The duration time T_{long} (time from the 10 % value on the front to the 10 % value on the tail) of this continuing current is typically more than 2 ms and less than 1 s (see Figure A.2)

3.7
multiple strokes
lightning flash consisting on average of 3-4 strokes, with typical time interval between them of about 50 ms

NOTE Events having up to a few dozen strokes with intervals between them ranging from 10 ms to 250 ms have been reported.

3.8
point of strike
point where a lightning flash strikes the earth, or protruding object (e.g. structure, LPS, service, tree, etc.)

NOTE A lightning flash may have more than one point of strike.

3.9
lightning current
i
current flowing at the point of strike

3.10
peak value
I
maximum value of the lightning current

3.11
average steepness of the front of short stroke current
average rate of change of current within a time interval $t_2 - t_1$

NOTE It is expressed by the difference $i(t_2) - i(t_1)$ of the values of the current at the start and at the end of this interval, divided by $t_2 - t_1$ (see Figure A.1).

3.12
front time of short stroke current
T_1
virtual parameter defined as 1,25 times the time interval between the instants when the 10 % and 90 % of the peak value are reached (see Figure A.1)

3.13
virtual origin of short stroke current
O_1
point of intersection with time axis of a straight line drawn through the 10 % and the 90 % reference points on the stroke current front (see Figure A.1); it precedes by 0,1 T_1 that instant at which the current attains 10 % of its peak value

3.14
time to half value of short stroke current
T_2
virtual parameter defined as the time interval between the virtual origin O_1 and the instant at which the current has decreased to half the peak value (see Figure A.1)

3.15
flash duration
T
time for which the lightning current flows at the point of strike

3.16
duration of long stroke current
T_{long}
time duration during which the current in a long stroke is between the 10 % of the peak value during the increase of the continuing current and 10 % of the peak value during the decrease of the continuing current (see Figure A.2)

3.17
flash charge
Q_{flash}
time integral of the lightning current for the entire lightning flash duration

3.18
short stroke charge
Q_{short}
time integral of the lightning current in a short stroke

3.19
long stroke charge
Q_{long}
time integral of the lightning current in a long stroke

3.20
specific energy
W/R
time integral of the square of the lightning current for the entire flash duration

NOTE It represents the energy dissipated by the lightning current in a unit resistance.

3.21
specific energy of short stroke current
time integral of the square of the lightning current for the duration of the short stroke

NOTE The specific energy in a long stroke current is negligible.

3.22
object to be protected
structure or service to be protected against the effects of lightning

3.23
structure to be protected
structure for which protection is required against the effects of lightning in accordance with this standard

NOTE A structure to be protected may be a part of a larger structure.

3.24
service to be protected
service connected to a structure for which protection is required against the effects of lightning in accordance with this standard

3.25
lightning flash to an object
lightning flash striking an object to be protected

3.26
lightning flash near an object
lightning flash striking close enough to an object to be protected that it may cause dangerous overvoltages

3.27
electrical system
system incorporating low voltage power supply components

3.28
electronic system
system incorporating sensitive electronic components such as communication equipment, computer, control and instrumentation systems, radio systems, power electronic installations

3.29
internal systems
electrical and electronic systems within a structure

3.30
physical damage
damage to a structure (or to its contents) or to a service due to mechanical, thermal, chemical and explosive effects of lightning

3.31
injury of living beings
injuries, including loss of life, to people or to animals due to touch and step voltages caused by lightning

3.32
failure of electrical and electronic systems
permanent damage of electrical and electronic systems due to LEMP

3.33
lightning electromagnetic impulse
LEMP
electromagnetic effects of lightning current

NOTE It includes conducted surges as well as radiated impulse electromagnetic field effects.

3.34
surge
transient wave appearing as overvoltage and /or overcurrent caused by LEMP

NOTE Surges caused by LEMP can arise from (partial) lightning currents, from induction effects in installation loops and as remaining threat downstream of SPD.

3.35
lightning protection zone
LPZ
zone where the lightning electromagnetic environment is defined

NOTE The zone boundaries of an LPZ are not necessarily physical boundaries (e.g. walls, floor and ceiling).

3.36
risk
R
value of probable average annual loss (humans and goods) due to lightning, relative to the total value (humans and goods) of the object to be protected

3.37
tolerable risk
R_T
maximum value of the risk which can be tolerated for the object to be protected

3.38
lightning protection level
LPL
number related to a set of lightning current parameters values relevant to the probability that the associated maximum and minimum design values will not be exceeded in naturally occurring lightning

NOTE Lightning protection level is used to design protection measures according to the relevant set of lightning current parameters.

3.39
protection measures
measures to be adopted in the object to be protected to reduce the risk

3.40
lightning protection system
LPS
complete system used to reduce physical damage due to lightning flashes to a structure

NOTE It consists of both external and internal lightning protection systems.

3.41
external lightning protection system
part of the LPS consisting of an air-termination system, a down-conductor system and an earth-termination system